Comparison of Asphalt Paving Emission Factors

The purpose of this document is to describe the various emission factors for hot-mix asphalt paving (EIC 540-564-0400-0000) that are now being used by districts and that have recently been developed. Current statewide emissions for this district-responsibility category are about 1.8 tons/day TOG in 2003. A recommendation as to which emission factor should be used by all districts is included.

0.8 pounds TOG/ ton of Asphalt applied

This emission factor is from a methodology, "Section 3-4, Asphalt Paving", found in an early edition of the Area Source Manual, dated December 1982 (with revisions through December 1984). This is a statewide methodology used by ARB staff for the 1979 area source inventory. It is not included in later editions of the manual. According to the methodology, the emission factor is from Documentation - 1977 Area Source Emissions (ARB, November 1979). This document could not be found and no other details regarding the emission factor assumptions are included in the methodology. A review of the CEIDARS database shows that most of the smaller districts use this emission factor.

0.04 pounds TOG/ ton of Asphalt applied

This emission factor is from a methodology, "Section D-4, Asphalt Paving" that was written by Michael Tollstrup who was then with the Fresno County APCD in 1982. This methodology is included in the December 1982 edition of the Area Source Manual but is not included in later editions. According to the introduction to the manual, this is a district methodology recommended by EITAC for the districts' use in estimating emissions for their own counties. The emission factor is from page 16 of ARB's Consideration of a Model Rule for Control of Volatile Organic Compound Emissions from Cutback Asphalt Paving Materials (May 1979) (ftp://ftp.arb.ca.gov/carbis/reports/l3013.pdf). Page 16 of this document says, "Emissions evolved from hot mixes are approximately 0.002 pounds per ton of mix or 0.04 pounds per ton of asphalt cement." The source of the 0.002 pounds per ton of mix is the KVB report, Control of Hydrocarbon Emissions from Stationary Sources in the California South Coast Air Basin (page 2-88, June 1978) (ftp://ftp.arb.ca.gov/carbis/research/apr/past/arb-5-1323a-vol2-app.pdf). According to the KVB report, "Data…showed that approximately 1 x 10^{-6} pounds of total hydrocarbons were released per pound of asphalt concrete laid." A review of the CEIDARS database shows that most of the larger districts use this emission factor.

STI's Asphalt Paving Methodology

STI's methodology (Attachment C) uses two emission factors for hot-mix asphalt paving. It uses the 0.04 pounds/ton for districts that limit the VOC contents of asphalts. For districts without these limits, STI has assumed that the factor of hot-mix asphalt is one order of magnitude smaller than that for emulsified asphalts, or about 0.9 pounds VOC per barrel applied. (The emission factor for emulsified asphalt, 9.2 pounds per barrel applied, is from EPA's EIIP methodology, Volume III, Chapter 17, Table 17.5-2.) Based on the EIIP assumption that 1 barrel of asphalt is 350 pounds (EIIP methodology, page

17.5-8), the 0.9 pounds of VOC per barrel is equivalent to 5.143 pounds of VOC per ton of asphalt applied. This is almost 130 times larger than the 0.04 pounds per ton factor used for districts with VOC limits. According to the STI methodology, there are 14 districts without VOC limits on asphalts where the 5.143 pounds emission factor would be applied. Most of these districts are currently listed in CEIDARS as using the 0.8 pounds per ton emission factor.

Recommendation

The underlying assumptions used to derive the ARB emission factor of 0.8 pounds/ton could not be found. For STI's emission factor of 0.9 pounds/barrel, no data were presented to support STI's assumption that the hot-mix asphalt paving emission factor is one order of magnitude smaller than the emulsified asphalt emission factor. Applying STI's emission factor in districts that currently use 0.8 pounds/ton would increase their emissions six times. Given that the 0.04 pounds/ton emission factor can be documented, it is recommended that this factor be used for all districts in California. As was mentioned above, the larger districts already use the 0.04 factor. Switching the factor for smaller districts from 0.8 to 0.04 would result in the overall statewide emissions for 2003 dropping from 1.81 tons/day to 0.47 tons/day.